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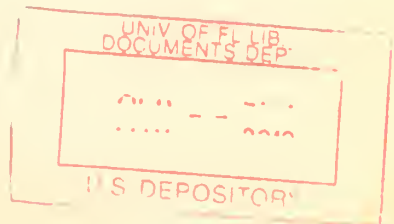
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ORIGIN OF THE HINDI COTTON.

BY
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ORIGIN OF THE HINDI COTTON.

INTRODUCTION.

Hindi is the name applied in Egypt to an undesirable type of cotton with a short, weak fiber, that injures the high-grade Egyptian varieties by infesting them with hybrids. The skill and cheapness of the native Egyptian labor enable the exporters to have the cotton sorted by hand in their baling establishments, so that a high reputation for uniformity has been secured in spite of the Hindi admixture.

The introduction of the Egyptian cotton into the United States brings also the problem of the Hindi cotton, but without the resource of cheap labor which enables the difficulty to be surmounted in Egypt. The practicability of establishing a commercial culture of the Egyptian cotton in the United States depends largely upon the elimination of the Hindi contamination and other forms of diversity, so that the fiber may be produced in a satisfactory condition of uniformity. The Hindi cotton problem might be compared to that of the red rice that mixes with the white and depreciates the value of the crop. In the case of the cotton there is a better prospect that adequate knowledge of the vegetative characters may enable the undesirable plants to be removed from the fields without too seriously increasing the cost of production.

DIAGNOSTIC CHARACTERS OF THE HINDI COTTON.

The Hindi cotton usually appears more vigorous and robust than the adjacent Egyptian plants by reason of the larger number of vegetative branches developed from the lower nodes of the central stalk. The vegetative branches also take a more nearly upright position, rendering the plants more compact and bushy in their general shape, as well as more densely leafy. The leaves are much thinner in texture than those of the Egyptian cotton and of a lighter and more yellowish green. The difference is particularly striking in Arizona, where the Egyptian cotton usually is of a very dark grayish or bluish green. The lateral lobes appear very short and broad in comparison with the Egyptian cotton, or even with many of our Upland varie-

ties. The lateral angles of the leaf are produced so little that the outer margin is left nearly straight if the middle lobe is cut off. (See fig. 1 and compare with fig. 2.) The pulvinus at the base of the leaf blade is red, as well as the adjacent part of the petiole, and especially the somewhat swollen upper side of the end of the petiole, which may be looked upon as a part of the pulvinus. The involucrel bracts are nearly orbicular, very deeply cordate at base and margined with numerous long teeth. The calyx has long-pointed trian-



FIG. 1.—Leaf of Jaunovitch Egyptian cotton (natural size).

gular lobes. The petals are creamy white and the petal spot faint or entirely lacking. The small conic bolls have three, four, or five carpels or locks, and are of a pale-green color, with few and deeply buried oil glands. The lint is white and of very inferior quality. The seeds are longer and more angular than in the Egyptian cotton, and the surface is usually completely naked after the lint is removed. In rare cases there may be fuzz at the ends of the seeds, as in the Egyptian cotton, or even a larger amount.

SUPPOSED RELATION OF HINDI COTTON TO UNITED STATES
UPLAND VARIETIES.

The nature and origin of the Hindi cotton appear to have been the subject of as much popular speculation in Egypt as the red rice in the United States. The word "Hindi" is the Arabic equivalent of our word "Indian." Some writers have taken this to mean that the cotton came from Hindustan, while others consider that the name



FIG. 2.—Leaf of Hindi cotton (natural size).

Hindi might be applied to any foreign plant and has no particular significance as an indication of origin. A third opinion is that this cotton is either a native Egyptian variety or one that was cultivated in the country before the present commercial type. The reason given for this idea is that this cotton is frequently found in a wild or spontaneous condition in uncultivated or abandoned lands.

The suggestions of scientific students of the Hindi cotton are hardly more consistent. Sir George Watt's monograph of cotton connects the Hindi plant with no less than three species supposed to be native in different parts of the world, but he refers it most directly to *Gossypium punctatum*, and states that this species grows wild in the United States. Some of our cultivated Upland cottons, such as the King variety, are reckoned as varieties or hybrids of *Gossypium punctatum*, and the Moqui cotton of the Arizona Indians is definitely referred to this species.^a

In reality there is no wild cotton in any of the cotton-growing regions of the United States. In Texas and other Gulf States warm winters often allow the roots to survive and send up new shoots in the spring, but in cold years all the cotton is killed throughout the cotton belt. The only indigenous wild type of cotton known in the United States is that found in the extreme southern part of Florida and on the Florida Keys, unless we take into account the varieties cultivated by the Indians of Arizona, and these varieties have never been planted in other parts of the United States except in very recent experiments.

Watt dwells in particular upon the claim that the Hindi cotton resembles Moqui cotton from Arizona; but when the living plants are compared, the resemblance between the Moqui and Hindi cottons appears no greater than that between the Hindi and our Upland varieties. The Hindi cotton finds a much closer alliance with other types of cotton from southern Mexico and Central America. These types belong to the general Upland series, but they have not been known in the United States until very recently and have been planted thus far only in a few localities and only on an experimental basis.

HINDI COTTON RELATED TO MEXICAN VARIETIES.

The vegetative characters of the Hindi cotton show the closest approximation to those of some of the Mexican varieties from the State of Chiapas and in particular to a type obtained by Mr. G. N. Collins in 1906 at the town of Acala. There are the same light, yellowish green, broad, short-lobed, smooth, naked leaves and the same strongly zigzag fruiting branches which frequently branch again from the axillary buds. As in the Hindi cotton, the bolls are pale green, the oil glands that show as black dots on the bolls of Egyptian cotton being buried deeply in the green tissues. The involucrel bracts are rounded and very deeply cordate at base, as in the Hindi cotton, and the margins have longer and coarser teeth, carried down nearer

^a Watt, St. George. The Wild and Cultivated Cotton Plants of the World. London, 1907. p. 181.

to the base than in our Upland cottons. The calyx of the Hindi cotton has large triangular lobes, and these are often produced into a long, slender tip, as in many Mexican and Central American varieties, including that from Acala.

Many of the plants of the Acala cotton growing at San Antonio in August, 1909, were remarkably close counterparts of some of the Hindi plants of the Jannovitch row in the same field. The chief difference lies in the greater fertility of the Mexican cottons, some of which appear worthy of cultivation in the United States, since they have larger bolls and better lint than our United States Upland varieties. The Hindi cotton is markedly infertile or fruits very late, but this fact may be connected with its status as a reversion. Mutative variations, like hybrids, are often more or less completely sterile.

The Egyptian and the Upland types both have definitely specialized fruiting branches, but the fruiting branches of the Hindi cotton show a much greater tendency to keep an ascending position and continue their vegetative growth, the young flower buds being often aborted. The same tendency is often seen in aberrant plants of Egyptian cotton, including many that show Hindi characteristics. The fruiting branches of the Hindi hybrids are usually few and short and some of the Hindi-like plants are completely sterile, as already stated. This is in notable contrast with the behavior of the hybrids between the Egyptian and Upland cotton, which have the fruiting branches better developed than in the pure Egyptian stocks.

COTTON INDIGENOUS IN AMERICA.

The resemblance between the Mexican and the Hindi cotton from Egypt may not appear to be a sufficient proof of the American origin of the Hindi cotton. It might be thought more likely that cotton had been carried from Egypt to Mexico than from Mexico to Egypt. Account must be taken of the further fact that Mexican and Central American varieties are members of a large natural group. The numerous local types are appreciably different and yet they have so many characters in common that the whole group must be looked upon as an indigenous product instead of a recent importation. The long, narrowly attenuate lobes that render the Hindi calyx so widely different from the Egyptian is a feature commonly accentuated in many of the Mexican and Central American types, though very rarely found in our United States Upland varieties.

How the Hindi cotton was introduced into Egypt is likely to remain a matter of conjecture, for the history of the Egyptian cotton itself is altogether obscure. That it came to Egypt from India is not to be considered impossible, for in India, as in Egypt, large numbers of

varieties have been imported at different times for experimental purposes. Some American cottons appear to have been cultivated in India for a long time, perhaps dating back to early Portuguese introductions from Brazil. All that can be said at present is that none of the cottons from India that have been grown in the United States show any close approximation to the Hindi cotton.

The idea of the Hindi cotton as a wild plant in Egypt may have been strengthened, if not suggested in the first place, by the fact that Egyptian cotton stunted by dry soil or other unfavorable conditions shows a stronger resemblance to the Hindi. The first leaves of the Egyptian cotton have nearly the same shape and color as the adult leaves of the Hindi, and stunted plants continue to produce the juvenile form of leaves. The proportions of adult Hindi plants also appear to be influenced by the external conditions in different plantings of the same stock of seeds. It does not seem unreasonable to suppose that Egyptian cotton escaped from cultivation might go over more and more to the Hindi type. A further reason for considering the Hindi cotton as a collateral relative of the Egyptian, if not a truly ancestral form, may be found in the fact that many hybrids between the Egyptian cotton and United States Upland varieties show Hindi characteristics rather than those of the parental types.

The fact that the affinities of the Hindi cotton have been so long misjudged would tend to show that Indian and Egyptian students of cotton have not been familiar with the Mexican and Central American types. It is possible that the Hindi contamination already existed in the Egyptian cotton when it was introduced into Egypt and that its existence in that country resulted from reversion rather than from local contamination. The Sea Island cotton of the United States, that has never been in Egypt, also shows sudden variations, the so-called "male stalks" or "bull cotton," commonly reckoned as hybrids, but having a general similarity to the Hindi reversions of the Egyptian cotton and the same tendency to sterility and inferior fiber.^a

RELATIONSHIPS OF EGYPTIAN COTTON.

There are also many indigenous varieties of the general Sea Island type of cotton in the American Tropics, and often in the same localities with indigenous Upland varieties, so that opportunities for crosses may have existed through long periods of time. Some of the Mexican and Central American varieties of the Upland series share the long-pointed bolls and some of the other characters of the Sea

^a Orton, W. A. Sea Island Cotton: Its Culture, Improvement, and Diseases. Farmers' Bulletin 302, U. S. Dept. of Agriculture, 1907, p. 29.

Island series, and it is not impossible that a complete series of intermediate types may yet be discovered in tropical America.

Watt's recent assignment of the Egyptian cotton to another botanical species (*Gossypium peruvianum*) instead of to the Sea Island species (*G. barbadense*) should not be allowed to confuse the issue, for the two types do not appear to have any essential differences to justify such a separation. The range of diversity shown by the Egyptian cottons during the period of acclimatization leaves no doubt that they are closely allied to the Sea Island cotton. There are individual Egyptian plants, with lighter color and narrower lobes than usual, that simulate the Sea Island cotton very closely, without any serious departure from the usual Egyptian characteristics. The most pronounced differences that sometimes appear to separate the two types are the darker green color of the Egyptian foliage and the smaller tendency of the Egyptian cotton to produce fertile branches on the lower part of the plant. Both these characters are known to be easily influenced by external conditions and individual selection, as in the Upland types of cotton.

A planting of Sea Island cotton at Falfurrias, Tex., in the season of 1909 showed several plants strikingly similar to Egyptian cotton, much taller and less fertile than their neighbors, and with the coarser, darker foliage and the relatively short buff lint of the Egyptian—apparently complete reversions from the Sea Island to the Egyptian type. Indeed, the approximation was in this instance so close as to call for repetitions of the experiment to exclude every possibility of admixture of seed. The same stock of Sea Island seed handled in the same way at New Braunfels, Tex., produced none of the Egyptian-like plants, but many similar cases have occurred where diversities have appeared in some places and not in others. Darker lint accompanies darker foliage among the Egyptian plants as well as among the Sea Island. The two series undoubtedly overlap, whether they are capable of showing the same extremes or not.

The question of the botanical name that should be applied to the Hindi cotton may well be left open until more definite knowledge is available regarding the botanical identity of other Mexican types. The Hindi cotton may prove to be close to the original of Todaro's *Gossypium mexicanum*, but may also be distinct, if Watt is correct in referring our big-boll Upland varieties to that species. Todaro's *Gossypium microcarpum* is another Mexican species to be considered in the identification of the Hindi cotton, for some of the Mexican relatives of the Hindi cotton show narrow-leaved forms that may have furnished the originals of Todaro's species, though they have no apparent relation to some of the varied types that Watt assembles under this name.

POSSIBILITIES OF UPLAND ADMIXTURE IN EGYPT.

That some of the so-called "Hindi contamination" in Egypt may be due to hybridization with true United States Upland cottons is not to be denied, for it is probable that many experimental plantings of Upland cotton have been made in Egypt, affording opportunities for crossing to take place. Recent reports indicate that some of the Egyptian planters are adopting the Upland cotton as a regular crop, owing to a serious decline in the yield of the Egyptian cotton in the last few years. Indications of a previous contamination with Upland cotton appear in the Ashmuni variety of Egyptian cotton as grown at Yuma in 1909 from newly imported seed. The Ashmuni field showed numerous Hindi plants different from those that appeared in other varieties in being distinctly hairy. In addition to the hairy Hindi plants there were several small hairy individuals that lacked other distinctive Hindi characters, such as the light-colored, short-lobed leaves, and approached in these respects some of the forms of Upland cotton. The hairy Hindi plants might also be taken to indicate Upland hybridization, in view of the strong tendency of the Hindi characters to come to expression in Egyptian-Upland hybrids. These hybrid reversions sometimes take on the complete Hindi form and show very few or none of the Egyptian or Upland characters.

CONCLUSIONS.

Experiments with Egyptian cotton in Arizona show that the so-called "Hindi" variations which appear among plants grown from seed imported from Egypt are one of the principal factors of the diversity that would diminish the commercial value of the fiber.

Comparisons with other types indicate that the Hindi cotton is of American origin instead of a result of hybridization with a native Egyptian or other Old World species of cotton as various writers have assumed.

On the other hand, the Hindi cotton does not prove to be identical with any of our United States Upland varieties, as supposed by Watt. It finds a much closer alliance with other types of Upland cotton indigenous in Mexico and Central America.

As the Egyptian and other Sea Island types also appear to have originated in tropical America, it becomes possible to view the Hindi variants as examples of reversion to remote ancestral characters rather than as results of recent hybridization. The similarity of the Hindi foliage to that of young plants of Egyptian cotton accords with this interpretation.

Although reversion to Hindi characters frequently occurs when the Egyptian cotton is hybridized with United States Upland varieties, there are also many Upland characters that seldom or never appear among the Hindi reversions and thus enable recent contamination with Upland cotton to be detected.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., October 19, 1909.

NOTE.—After this circular was written, the Library of the Department of Agriculture acquired a set of the files of the Cairo Scientific Journal, a recently established publication not hitherto accessible in Washington. Two papers touching upon the origin of the Hindi cotton and containing many interesting historical facts appeared in this journal in 1908, both by scientific investigators resident in Egypt. The first paper, written by Mr. W. Lawrence Balls for the July number, inclines to the current idea that the Hindi cotton is a native of Egypt and adjacent regions, though adducing no direct evidence. The second paper, in the November number, is by Mr. F. Fletcher, who had previously lived in India and investigated the Indian cottons.

The Hindi cotton is said not to be grown in India at the present day, but Fletcher states that "it is cultivated near Bagdad under this same title and is supposed to have been introduced there from India, as its name suggests." No consideration is given to the idea of the Hindi cotton as a native of Egypt, Watt's view of its relations to *Gossypium punctatum* and American Upland cottons being apparently accepted. The possibility of a Central African origin of the Hindi cotton is noted, on the basis of a Hindi-like herbarium specimen dating from 1863 labeled as representing a cotton introduced into Egypt from Cordofan. Fletcher adds that he has "received many samples of seed from Central Africa, but none of these have given rise to Hindi plants."

Still older specimens from Upper Egypt and Abyssinia, described by early authors under the name *frutescens* and considered by Balls as possibly pertaining to Hindi, are shown by Fletcher to be true Old World types, not related to the Hindi cotton or to the Egyptian. Balls also refers to *Gossypium vitifolium* as a Central African cotton with "free, naked seeds." Fletcher does not look upon *G. vitifolium* as related to the Hindi cotton, but accepts it as one of the ancestors of the Egyptian, the Sea Island as the other. Balls finds that a variety of Sea Island cotton has been cultivated at Raula, in the Menuiyeh district, for thirty years, which may explain the tendency of the Egyptian cotton to vary in the direction of the Sea Island.

Fletcher also studied at Paris Lamarek's original type of *vitifolium*, supposed to come from Celebes, though the locality is doubtful. He concludes that an Egyptian specimen referred to Lamarek's species by Delile over a century ago was correctly identified, and gives photographs of the original specimens, which are not altogether favorable to his conclusions. It can be seen that the involueral bracts of Lamarek's plant were of distinctly un-Egyptian form, the teeth being coarse and long and extending far down toward the base of the bracts, as in the Hindi cotton. Fletcher also considers that the Delile plant agrees with a specimen of "Jumel" cotton sent from Egypt to

Todaro about 1866 with a statement that it had been introduced from Ceylon about forty years before.

Historical accounts collected by Balls indicate that the field culture of long-staple cotton in Egypt was begun by Mohammed Ali in 1821 at the instance of Jumel, a French engineer. The superior type adopted by Jumel was not a new introduction, but a perennial "tree" cotton that was being planted as an ornamental in gardens at Cairo, and supposed to come from India. Several direct introductions of Sea Island and Brazilian cotton appear to have been made subsequently, but without displacing the variety that had been popularized by Jumel. Balls is inclined to ascribe the brownish color of the Egyptian cotton to these Brazilian introductions, but Fletcher believes that Jumel's cotton was brown, like some of the Brazilian cottons.

If the Egyptian cotton came by way of India the name Hindi that is now given to inferior plants may be only an echo of the original introduction of the Egyptian cotton itself. Any cotton brought from India might be called Hindi at first, and this name would serve in later years for the residual stock, after local varieties with special names began to be distinguished. Balls shows that there were numerous varieties of Egyptian cotton with distinctive names before the Mit Afifi type was introduced in 1882. After the use of the improved types became general the old name might still be applied to inferior variations or even to accidental hybrids. The origin of the name appears to have no bearing in this case upon the origin of the plant. Local varieties of cotton might have been taken to India from any part of tropical America, though more likely to have come from Brazil, where the Portuguese ships were accustomed to stop on their way around the Cape of Good Hope.

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